PROJECT MANUAL
(including specifications) FOR
CONSTRUCTION OF THE:

County of Sonoma
CMP High Efficiency Boiler Replacement

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Santa Rosa, CA 95403

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THIS ATTACHMENT IS PART
OF THE APPROVED PLANS.
DO NOT SEPARATE.
1/25/2024
Ronald Morris
PERMIT SONOMA ENGINEERING

SEALS PAGE

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SECTION 23 00 00

GENERAL REQUIREMENTS - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

PART 1 – GENERAL

1.01 DESCRIPTION

A. The requirements of this section apply to all sections of Division 23.

B. Section 23 00 00 includes General Requirements for Division 23 work including, but not limited to the following sections:

1.	Section 23 05 53	Identification for HVAC Piping and Equipment
2.	Section 23 05 93	Testing, Adjusting, and Balancing
3.	Section 23 07 00	Thermal Insulation for Mechanical Systems
4.	Section 23 21 13	Hydronic Piping and Specialties
5.	Section 23 51 23	Gas Vents

1.02 WORK INCLUDED

A. Provide all materials, equipment, labor, fabrication, specialties, and items necessary and incidental to the installations of a complete system or piece of equipment.

B. Work included shall also include transportation, storage, utilities and required licenses and permits.

1.03 RELATED WORK AND REQUIREMENTS

A. The work of this Section shall require work in coordination with other Divisions outside of this Section as follows:

1.	Division 00	Procurement and Contracting Requirements
2.	Division 01	General Requirements
3.	Section 26 00 00	General Requirements, Electrical

1.04 QUALITY ASSURANCE

A. Comply with Division 01 requirements regarding Quality Control.

B. Mechanical, electrical, and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are

experienced specialists in the required product lines. All construction firms and personnel shall be experienced and qualified specialists in their respective industrial and institutional HVAC system, as applicable.

C. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. However, digital electronics devices, software and systems such as controls, instruments, computer workstation, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions.

2. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.

3. Conform to codes and standards as required by the specifications. Conform to local codes, if required by local authorities such as the natural gas supplier, if the local codes are more stringent than those specified, the more stringent requirement shall be used.

4. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.

5. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.

6. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

1.05 SUBMITTALS

A. Comply with Division 01 requirements regarding submittals.

B. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.

C. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

D. Prior to submitting layout drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

E. Upon request by Engineer, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with telephone numbers and e-mail addresses.

F. Submittals and layout drawings for interdependent items, containing applicable descriptive information, shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient installation. Final review and approvals will be made only by groups. Submittals and shop drawings shall also incorporate the following items:

1. Clear and neat strike out of irrelevant information.

2. Clearly and neatly tag and mark equipment, options and specialties and special features.

3. Key tags to match tags on Drawings.

    a. If substituting on Specified equipment provide comprehensive written comparison of characteristics between specified and substituted equipment.

4. Provide information in an easily readable and legible format presentation.

5. Provide an index with corresponding labeled and tabbed dividers for sections, in a three-ring hard cover binder or hard cover binding folder. Loose leaf sections, provided separately, shall not be acceptable. Front index shall include, at a minimum:

    a. Full, formal, name and address, including zip code, for job.

    b. Company name, address, phone and fax numbers of General Contractor, including phone land line number of job trailer and cellular phone number and name of job site Superintendent.

6. Submit all items at same time, including all controls information, in one binder/folder. Excluding controls for a later, separate, review shall not be acceptable.

7. Unless specified otherwise in Division 01 requirements submit 5 copies of data. Engineer will return 4 copies while retaining one for internal office use as a Project Record Document.

8. Electronic copies shall be an acceptable submittal medium provided requirements of Division 01 are met.

9. Submittals shall be prepared and submitted in a timely fashion to allow adequate time for ordering of long lead time equipment and materials.

G. Layout and Coordination Drawings:

1. Submit complete, consolidated, and coordinated layout drawings for all new systems, and for existing systems that are in the same areas. Refer to the General Conditions.

2. The drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1/8-inch equal to one foot. Clearly identify and dimension, horizontally and vertically, the proposed locations of the principal items of equipment. The drawings shall clearly show locations and adequate clearance for all equipment, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and maintenance. Provide detailed layout drawings of all piping and duct systems.

3. Do not install equipment foundations, equipment or piping until layout drawings have been approved.

4. In addition, for HVAC systems, provide details of the following:

a. Mechanical equipment rooms.

b. Hangers, inserts, supports, and bracing.

c. Pipe sleeves.

d. Duct or equipment penetrations of floors, walls, ceilings, or roofs.

5. Failure of Contractor to provide adequate coordination and Coordination Drawings shall not be grounds for adjustment of Project cost or extension of time.

H. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.

1. Submit belt drive with the driven equipment. Submit selection data for specific drives when requested by the Engineer of Record.

2. Submit electric motor data and variable speed drive data with the driven equipment.

3. Equipment and materials identification.

4. Fire-stopping materials.

5. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.

6. Wall, floor, and ceiling plates.

1.06 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether the Owner has reimbursed the Contractor for the equipment and material, or not. The Contractor is solely responsible for the protection of such equipment and material against any damage.

2. Place damaged equipment in first class, new operating condition; or replace same as determined and directed by the Engineer.

3. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.

4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Equipment and Products:

1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping or ductwork.

2. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.07 CODES, REGULATIONS, STANDARDS, AND GUIDELINES

A. Work shall be in accordance with requirements of the latest jurisdiction adopted editions of the following:

1.	CBC	-	California Building Code, 2022 Edition
2.	CMC	-	California Mechanical Code, 2022 Edition
3.	CPC	-	California Plumbing Code, 2022 Edition
4.	CGBCS		California Green Building Construction Standards, 2022 Edition
5.	CEC	-	California Electrical Code, 2022 Edition
6.	CFC	-	California Fire Code, 2022 Edition
7.	CEC	-	California Energy Commission, Title 24, Part VI, 2022 Edition

B. The work shall comply with the latest editions of the following guidelines and standards:

1.	AABC	Associated Air Balance Council
2.	AGA	American Gas Association
3.	AMCA	Air Movement and Control Association
4.	ANSI	American National Standards Institute
5.	ARI	American Refrigeration Institute
6.	ASHRAE	American Society of Heating Refrigerating and Air Conditioning Engineers
7.	ASME	American Society of Mechanical Engineers
8.	ASTM	American Society for Testing and Materials
9.	NEC	National Electric Code
10.	NFPA	National Fire Protection Association
11.	SMACNA	Sheetmetal and Air-Conditioning Contractors National Association
12.	UL	Underwriters Laboratories

C. When the work calls for more stringent requirements than the above listings the Specifications and Drawings shall take precedence.

1.08 SITE VISIT AND FAMILIARIZATION

A. Visit the site and become familiar with the Drawings and Specifications. Examine the site and understand the conditions under which the Contract shall be performed.

B. Refer to Division 01 for any Pre-Bid Conference requirements.

1.09 REVIEW OF CONSTRUCTION

A. Work may be reviewed, without prior notice, at any time by representatives of the Owner.

B. Advise Owner when work is ready for review at the following times:

1. Prior to concealment of work in walls.

2. Prior to concealment of work and above ceilings and any other enclosable spaces. Conceal Work only after obtaining Owner and Architect consent.

3. Maintain an on the job set of Specifications and Drawings for use by Owner and representatives.

1.10 BID DOCUMENT DESCRIPTION

A. Specifications describe quality of materials and equipment.

B. Drawings describe the work in diagrammatic form. Drawings do not show exact detail and arrangements. Final requirements of the Work shall be determined by the Contractor after coordination with other trades.

C. All equipment, systems and items indicated on the drawings and specifications are to be assumed as new unless specifically noted otherwise.

1.11 DEFINITIONS

A. Definitions following may not match those in other sections. Definitions listed here govern this part of the Work and take precedence over those listed elsewhere.

1.	Concealed	Embedded within the construction or installed in furred spaces, within partitions or hung ceilings, in trenches, crawl spaces, or within enclosures.
2.	Connect	Complete hook-up of items with required services including all final items necessary for a completely functional installation.
3.	Down	A vertical pipe, duct or piece of work that does penetrate a floor.
4.	Drop	A vertical pipe, duct or piece of work that does not penetrate a floor.

5.	Exposed	Not installed underground or concealed as defined within this list.
6.	Indicated	As indicated on the Drawings and Specifications.
7.	Install	To erect, mount and connect complete with related accessories.
8.	Noted	As indicated on the Drawings and Specifications.
9.	Provide	To furnish, supply, install and connect up complete, ready, safe and in regular operation of particular work referred to.
10.	Riser	A vertical pipe, duct or piece of work having a vertical length greater than one story height.
11.	Shown	As indicated on the Drawings and Specifications.
12.	Supply	To purchase, procure, acquire and deliver compete with related accessories.
13.	Work	Labor, materials, equipment, apparatus, controls, accessories and other items required for complete and proper operation.

PART 2 – PRODUCTS

2.01 NOT USED

PART 3 – EXECUTION

3.01 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and handling shall be performed in accordance with manufacturer's recommendations. Provide dust and weather covers.

B. Protect materials from loss or damage. Lost or damaged materials shall be replaced with new at no increase in Contract Sum.

C. All mechanical equipment requiring power shall be installed with the required working spaces clearances required by the California Electrical Code, Table 110.26 (A)(1) Working Spaces.

D. All facility service piping and conduits shall be concealed behind finishes. No exposed piping or raceways will be permitted unless specifically noted in writing on the drawings. Coordinate with pertinent sections of other Divisions providing demolition and new finishes. Jointly determine extent of demolition and finish removal necessary to install all indicated facilities services systems concealed behind wall, floor, ceiling finishes.

3.02 PROTECTION OF WORK

A. Cap all duct, pipe, and equipment openings daily to protect from dust, moisture and incidental debris. Equipment not capped shall be thoroughly cleaned prior to recommencing construction.

B. Porous materials that become wetted shall be replaced with new. Drying is not sufficient as it introduces the possibility of microbial growth. This applies to duct liner, insulation wrap, flex duct and any material that has the potential to absorb moisture.

C. All air distribution shall be capped during construction to prevent accumulation of dirt, dust, and debris.

3.03 CLEANING AND PRESENTATION

A. Prepare Work for painting by leaving surfaces free of oil, dust, rust, scale, adhesions, and debris.

B. Remove all shipping labels and tags.

C. Exterior surfaces of piping, insulation, ducting and equipment shall be left clean.

D. Inside visible portions of grille cans and adjacent ducting including insulation stick pins, dampers and specialties shall be painted with two coats of flat black paint.

E. Scratched and marred surfaces of factory painted equipment and materials shall be touched up with matching color/type paint.

1. Clean as recommended by manufacturer. Do not use material or methods which may damage finish surface or surrounding construction.

F. Cut ends of strut pieces and uncoated/non-galvanized steel materials exposed to the elements shall be painted with two coats of rust inhibiting paint with color and type matched to installation.

3.04 SAFETY

A. The contractor shall be solely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This shall also apply to normal and non-normal working hours.

3.05 CUTTING OF STRUCTURE

A. Do not cut beams, girders, columns, or any other structural members, or run any pipes, ducts, or work through slabs, unless specifically shown on the Drawings, or unless written approval is obtained from the Owner.

B. Cutting of walls, floors, or other parts of the building or repairing any work due to neglect of properly directing the locations of necessary openings and framing beforehand shall be done at no additional cost to the Owner.

3.06 SPECIAL TOOLS

A. Furnish to Owner one set of special tools required to operate, adjust, dismantle, or repair any equipment within this Division. Special tools mean those not normally found in possession of mechanics or maintenance personnel. Also provide location of supplier where extra sets can be purchased.

3.07 RECORD DRAWINGS

A. Contractor is required to provide record Drawings in accordance with Division 01 and this section.

B. Keep and accurate record of job progress including as-built locations and of the Work. Keep record up-to-date on legible copies as job progresses. Drawings shall be of the same size as provided to the contractor. Make available to Owner and Owner representatives during job.

C. In addition to any other requirements, include on as-built Drawings the following:

1. Changes in location of piping, duct, or equipment.

2. Ceiling access panel locations.

3. Position of buried or concealed mains accurately dimensioned, both horizontally and vertically.

3.08 COMPLETION

A. When work is completed, or when Owner or Owner representative directs, remove surplus equipment, material, waste, and rubbish, and leave building in satisfactory condition.

B. Adjust and program thermostats and controls per owner direction and as indicated within Division 23 requirements.

3.09 WARRANTEES AND GUARANTEES

A. Contractor is required to provide warranties in accordance with Division 01 – General Requirements.

1. Collect all warranties and guarantees for materials and equipment and neatly fill out all required information for the Owner. Provide one copy of each certificate for turn over to Architect. Arrange certificates in a tabbed and indexed binder for Architect ease of use.

B. At the completion of the work contractor shall guarantee to repair or replace materials and workmanship found defective for a period of one year from date of filing of Notice of Completion. This work shall be performed at no cost to the Owner.

1. Work of other trades damaged because of faulty workmanship or materials shall be repaired at no cost to the Owner.

END OF SECTION

SECTION 23 05 53

HVAC IDENTIFICATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide complete HVAC system identification work for all equipment and ducting from point of connection at HVAC equipment to termination points. Types of HVAC identification shall consist of:

1. Painted Identification Materials

2. Plasticized Tags

3. Engraved Plastic Laminate Signs

4. Plastic Tape

B. Lettering, Size, Colors, and viewing angles of identification devices shall comply with ANSI A13.1.

C. All work of this section shall comply with Section 23 00 00 GENERAL REQUIREMENTS - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

PART 2 – PRODUCTS

2.01 HVAC IDENTIFICATION MATERIALS

A. Painted Identification Materials:

1. Stencils: Standard fiberboard stencils with letters not less than 1-1/4 inches high for ductwork and not less than ¾” inches high for access door signs and similar operational instructions.

2. Identification paint: Standard exterior type stenciling enamel of wither brushing grade or pressurized spray can form and grade.

3. Identification Paint: Standard identification enamel.

B. Plastic Tape

1. General: Manufacturer’s standard color-coded pressure sensitive self-adhesive vinyl tape, not less than 3 mils thick.

a. Width: Provide 1-1/2” inch wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6 inches, 2-1/2 inch wide tape for larger pipes.

b. Color: By ANSI A13.1 designation except where other color selection is indicated.

C. Engraved-Plastic Laminate Signs:

1. General: Provide engraving stock melamine plastic laminate complying with FS L-P-387 in the size and thickness indicated, engraved with engraver's standard letter style of the size and working indicated, black with white core (letter core) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

a. Thickness: 1/6 inch for units up to 20 sq. in. or 8 inch in length; 1/8 inch for larger units.

b. Fasteners: Self-tapping stainless screws, except contact type permanent adhesive where screws cannot or should not penetrate the substrate.

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceiling and removable concealment.

3.02 GENERAL DUCTWORK IDENTIFICATION

A. Identify air supply, return, exhaust, outside air and intake relief ducting with stenciled signs and arrows, showing ductwork service in direction of flow, in black or white (whichever provides best contrast)

B. In each space where ductwork is exposed, or concealed by removable ceiling system, locate signs near points of ductwork origin of where the ducts continue on into concealed enclosures and at 50 ft. spacing along exposed runs.

1. Access doors shall be provided with stenciled or plastic-laminate type signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions and appropriate safety and procedural information.

3.03 HVAC EQUIPMENT IDENTIFICATION

A. Install engraved plastic laminate signs on or near each equipment item and each operational device, if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

1. Boilers

2. Pumps

3. Air Separators

4. Significant Shut Off Valves (Isolation)

5. Main control and operating dampers, including safety devices and hazardous units.

B. Where lettering larger than 1 inch height is needed for proper identification, because of distance from normal location of required identification, stenciled signs may be provided in lieu of engraved plastic, at Installer's option.

C. Minimum 1/4" high lettering for name of unit where viewing distance is less than 2 feet and 1/2" high for distances up to 6 feet and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 or 3/4 the size of the principal lettering.

D. In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operating requirements, indicate safety and emergency precautions, and warn of hazard and improper operations.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Work Included: This Section covers requirements for testing, adjusting, and balancing work for the air distribution systems and associated equipment and apparatus described herein.

B. All work of this section shall comply with Section 23 00 00 GENERAL REQUIREMENTS - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC).

1.02 QUALITY ASSURANCE

A. Engage the services of an independent balancing and testing agency specializing in the balancing and testing of heating, ventilating and air conditioning systems to perform the work.

B. TAB Agency:

1. The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.

2. The TAB agency shall be a certified member of AABC to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the Engineer of Record and submit another TAB firm for approval. Any agency that has been the subject of disciplinary action by AABC within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency's review shows unsatisfactory work performed by the predecessor agency.

C. TAB Specialist:

1. The TAB specialist shall be a member of. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the Resident Engineer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by the AABC within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the

TAB specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by an approved successor.

2. TAB Specialist shall be identified by the General Contractor within 60 days after the notice to proceed. The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required by the Resident Engineer. The responsibilities would specifically include:

    a. Shall directly supervise all TAB work.

    b. Shall sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC.

    c. Would follow all TAB work through its satisfactory completion.

    d. Shall provide final markings of settings of all HVAC adjustment devices.

    e. Permanently mark location of duct test ports.

3. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity to this project. Qualifications must be certified by the TAB agency in writing.

4. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards. Provide calibration history of the instruments to be used for test and balance purpose.

5. Tab Criteria:

    a. One or more of the applicable AABC or SMACNA publications, supplemented by ASHRAE Handbook "HVAC Applications" Chapter 36, and requirements stated herein shall be the basis for planning, procedures, and reports.

    b. Flow rate tolerance: Following tolerances are allowed. For tolerances not mentioned herein follow ASHRAE Handbook "HVAC Applications", Chapter 36, as a guideline. Air Filter resistance during tests, artificially imposed if necessary, shall be at least 90 percent of final values for pre-filters and after-filters.

        1. Air handling unit and all other fans, cubic meters/min (cubic feet per minute): Minus 0 percent to plus l0 percent.

        2. Air terminal units (maximum values): Minus 2 percent to plus l0 percent.

3. Exhaust hoods/cabinets: 0 percent to plus l0 percent.

4. Minimum outside air: 0 percent to plus 10 percent.

5. Individual room air outlets and inlets, and air flow rates not mentioned above: Minus 2 percent to plus l0 percent except if the air to a space is 100 CFM or less the tolerance would be 0 to plus 5 percent.

6. Heating hot water pumps and hot water coils: Minus 5 percent to plus 5 percent.

c. Systems shall be adjusted for energy efficient operation as described in PART 3.

d. Typical TAB procedures and results shall be demonstrated to the Resident Engineer for one air distribution system (including all fans, three terminal units, three rooms) and one hydronic system (pumps and three coils) as follows:

1. When field TAB work begins.

2. During each partial final inspection and the final inspection for the project if requested by VA.

D. AABC Compliance: Comply with AABC's Manual MN-1 "AABC National Standards", as applicable to mechanical air distribution systems and associated equipment and apparatus, except as otherwise specified.

E. Industry Standards: Comply with American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE) recommendations pertaining to measurements, instruments, and testing, adjusting and balancing, except as otherwise specified.

1.03 SUBMITTALS

A. Comply with Submittal Requirements of Division 01.

B. Submit names and qualifications of TAB agency and TAB specialists within 60 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.

C. For use by the Resident Engineer staff, submit one complete set of applicable AABC publications that will be the basis of TAB work.

D. Submit Following for Review and Approval:

1. Design Review Report within 90 days for conventional design projects and within 60 days for design-build projects after the system layout on air and water side is completed by the Contractor.

2. Systems inspection report on equipment and installation for conformance with design.

3. Duct Air Leakage Test Report.

4. Systems Readiness Report.

5. Intermediate and Final TAB reports covering flow balance and adjustments, performance tests, vibration tests and sound tests.

6. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.

7. Submit certification that balancing personnel have been trained in accordance with AABC standards.

8. Submit certification of test equipment calibration and currency.

9. Maintenance Data: Include in maintenance manuals, copies of certified test reports.

10. Submit certified test reports signed by the Test and Balance Supervisor who performed testing and balancing work. In addition, have report certified by a Registered Professional Engineer who is familiar with testing and balancing work and also with project.

E. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area.

F. Make all other submittals specified under this Section.

1.04 JOB CONDITIONS

A. Do not proceed with TAB work until work has been completed and is operable. Ensure that there is no latent residual work still to be completed.

B. Do not proceed until work scheduled for testing, adjusting, and balancing is clean and free from debris, dirt and discarded building materials.

PART 2 – PRODUCTS

2.01 GENERAL

A. PATCHING MATERIALS: Except as otherwise indicated, use same products as used by original installer for patching holes in insulation, ductwork and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes. In each case, patching shall be completed by original installer.

B. TEST INSTRUMENTS: Utilize test instruments and equipment for testing and balancing work required, of type, precision, and capacity as recommended in AABC's Manual MN-1 "AABC National Standards".

2.02 PLUGS

A. Provide plastic plugs to seal holes drilled in ductwork for test purposes.

2.03 INSULATION REPAIR MATERIAL

A. Provide for repair of insulation removed or damaged for TAB work.

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS

A. Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned and is operable. Do not proceed with testing and balancing work until unsatisfactory conditions have been corrected in manner acceptable to Tester.

B. Test, adjust and balance environmental systems and components, as indicated, in accordance with procedures outlined in applicable standards.

C. Test, adjust and balance system during summer season for air conditioning systems and during winter season for heating systems, including at least period of operation at outside conditions within 5 °F (3 °C) wet bulb temperature of maximum summer design condition, and within 10 °F (6 °C) dry bulb temperature of minimum winter design condition. When seasonal operation does not permit measuring final temperatures, then take final temperature readings when seasonal operation does permit.

D. Prepare report of test results, including instrumentation calibration reports, in format recommended by applicable standards.

E. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes.

F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers and similar controls and devices, to show final settings at completion of testing and balancing work. Provide markings with paint or other suitable permanent identification materials.

G. Prepare a report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced, including, where necessary, modifications which exceed requirements of the Contract Documents. Submit report to the Engineer for review. Carry out corrective modifications as approved by the Engineer.

H. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

I. Units shall not be operated without air filters. Air filters shall be replaced completely after construction is complete and just prior to air balancing.

3.02 BALANCING PROCEDURES - WATER SYSTEMS

A. Prior to balancing the Contractor shall complete construction of piping systems with all components installed, and controls operative and calibrated. Schedule balancing for completion four calendar weeks prior to the completion of the building or the area the water system is servicing.

B. Verify the following conditions prior to balancing:

1. Piping systems have been flushed and treated in accordance with Hydronic Piping, Valves, and Specialties Section.

2. Strainers have been cleaned.

3. Inside of traps, reducing and regulating valves have been cleaned.

4. Expansion tanks are not air bound.

5. Piping systems are completely full of water, all air properly vented off.

6. All coil and isolation shut off and balance valves are fully open.

7. Check pumps:

a. Rotation

b. Pump factory impeller trimming by comparing shut off heads with pumps curves from approved submittals.

1. Report discrepancies in shut off head to Owner's Representative and if impeller does not appear to be properly trimmed, wait for direction before proceeding with pump test and balance.

8. DDC Operability:

a. Do not proceed with any of the following balancing procedures until the DDC system is capable of operating equipment such as fans, pumps, boiler, control valves, etc. in manual and automatic modes and capable of reading sensors such as differential pressure, flow rates, temperature, etc. of air and hydronic systems to be tested and balanced.

C. Pumps:

1. Test and report for each pump:

a. Tag, manufacturer and model of pump, motor manufacturer, service, model and size.

b. Motor horse power, volts, phase, full load amps.

c. Pump shut off head from curves and measured shut off head.

d. With all control valves open to coils:

1. Volts and amps, measured with handheld meter, and calculated brake power.

2. Entering and leaning gage pressure and difference in feet.

3. Suction, discharge and total flow rates, deduced from pump curve.

D. Hydronic system:

1. At three way valves, adjust balance valves in bypass leg as required to make pressure drop across the coil-valve assembly when valve is in full bypass position equal to that when the valve is in the through coil position. Leave isolation shut off valves full open.

a. Report:

1. Coils:

a) Tags of coils with 3- way valves that are balanced.

b) Inlet, outlet, and pressure drop across the assembly with valve open to coil.

c) Pressure drop across the assembly with valve open to bypass before and after bypass valve balance.

d) Hot water return temperature.

e) Hot water supply temperature.

f) Coil flow rate.

g) Design and final inlet and outlet pressures.

2. Boiler:

a) Design and measured differential pressure across boiler before and after balance.

b) Hot water return temperature.

c) Hot water supply temperature.

d) Design and final inlet and outlet pressures.

e) Calculated heating energy transferred to water, in btu/h.

f) Calculated efficiency (heat transferred to water divided by gas energy input).

3. Test control valve shutoff

a) Close all control valves in the system. Run pumps individually, at full speed, dead headed.

b) Verify that all control valves remain shut with no measurable flow, as indicated by pump differential pressure, and any temperature rise across coils.

c) Do not run pumps dead headed for more than five minutes at any one time.

d) Report:

e) Tag of coils where flow is detected.

f) Measured pump inlet and outlet pressures, with differences converted to feet.

3.03 PATCHING MATERIALS:

A. Except as otherwise indicated, use the same products as used in the original installation for patching holes in insulation, ductwork and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes. In each case, patching is to be completed by original installer.

3.04 MARKINGS:

A. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings at completion of testing, adjusting and balancing work. Provide markings with paint or other suitable permanent identification materials.

3.05 IDENTIFICATION OF TEST PORTS

A. The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

3.06 RECOMMENDATIONS

A. Prepare a report of recommendations to the Engineer for correcting unsatisfactory mechanical performance when systems cannot be successfully balanced, including, where necessary, modifications.

B. Retest, adjust and balance systems subsequent to significant system modifications and resubmit test results.

END OF SECTION

SECTION 23 07 00

THERMAL INSULATION FOR MECHANICAL SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work covered under this section consists of providing all necessary labor, supervision, materials, equipment and services to completely execute the complete HVAC system insulation work for equipment, piping, ductwork and other items where shown on the drawings and required herein.

B. Insulate equipment and products at the following locations;

1. Where the fluid being transported is 60 degrees Fahrenheit or below in temperature.

2. Where the fluid being transported is 100 degrees Fahrenheit or above in temperature.

3. All hot surfaces above 120 degrees in temperature to prevent personnel burns.

4. All piping, equipment, ducting, valves, etc., which require insulation but come uninsulated from the manufacturer.

5. Hydronic piping insulation means insulation of all components of the piping system including, but not limited to, fittings, joints, flanges, equipment, valves, pump volutes, tanks, and all exposed surfaces subject to temperatures above 100 degrees or below 60 degrees, unless indicated otherwise elsewhere.

C. All work of this section shall comply with Section 23 00 00 GENERAL REQUIREMENTS - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC).

1.02 REFERENCES

A. Insulation work shall comply with the requirements of the 2013 California Energy Commission requirements.

B. ASTM E84 – Standard Test Method for surface Burning Characteristics of Building Materials (NFPA 255).

C. UL 723 – Test for Surface Burning Characteristics of Building Materials.

D. UL 263 – Fire Tests of Building Construction and Materials.

1.03 SUBMITTALS

A. Comply with Division 01 requirements in addition to Section 23 00 00 for submittals and coordinated shop drawings.

B. Submit product data on all insulation products inclusive of R-Value, flame spread rating, developed smoke rating and locations.

PART 2 – PRODUCTS

2.01 GENERAL

A. The type of insulation and its installation shall be in accordance with this Specification for each service and the application technique shall be as recommended by the manufacturer.

B. Fire Rating of all insulation shall have a composite (insulation, jacket/facing and adhesive used to adhere facing or jacket to insulation) fire and smoke hazard, as tested by ASTM E84, UL 263, and UL 723, not to exceed a flame spread of 25 and smoke developed by 50.

1. Accessories such as adhesives, mastics, tapes, and cements shall have the same component ratings as listed herein.

2. Products shall have integral factory labeling indicating that flame spread and developed smoke ratings do not exceed the above requirements.

2.02 HYDRONIC PIPING INSULATION

A. Insulation shall be molded fiberglass with a minimum density of 3.5 pounds per cubic foot with a maximum thermal conductivity of 0.25 BTUH/sq. ft. deg. F/in at 75 degrees.

B. Jacketing shall be factory applied, paintable, white kraft outer surface bonded to aluminum foil and reinforced with fiberglass yarn with self-sealing lap. Maximum vapor permeance shall be 0.02 perms with a minimum beach puncture of 50 units. Seal end joints with sealing strip or tape to provide vapor and weather tight installation.

C. Fittings and valves insulation shall consist of pre-molded PVC fitting covers over precut insulation of same thickness as adjacent piping.

D. Expansion joints (where applicable) shall be insulated with factory made insulation covers specifically made for the purpose. Covers shall be pre-shaped, shall cover entire joints including flanges and shall allow the anticipated movement of the joints without breaking the insulation of jacketing. Covers shall also be removable to facilitate inspection of joints by maintenance personnel.

E. Piping insulation shall be 1 1/2” thick for 4 inch and smaller piping. Insulate all supply and return hydronic piping.

F. Preformed calcium silicate blocks shall be used to isolate all piping from hangers and supports. Silicate blocks shall be held in place with metal sleeves/pipe saddles of type to match hanger and prevent galvanic action in case of wetting. Calcium silicate shall have a minimum density of 12.5 pounds per cubic foot with a maximum thermal conductivity of 0.40 BTUH/sq. ft. deg F/inch at 200 degrees.

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation products in accordance with the manufacturer's written instruction, commercial and industrial standards, and recognized industry practices to ensure that the insulation serves the intended purpose. Surfaces shall be thoroughly cleaned with all testing successfully completed prior to insulating.

B. In addition to where specified, provide insulation by type and locations as indicated on the Drawings.

C. After the installation of insulation protect the insulation from moisture and weather damage.

D. Provide complete weather protection for all outdoor piping insulation.

3.02 INSULATION LOCATIONS

A. Apply insulation by type and location as follows:

1. Hydronic Piping Insulation

a. Insulate supply and return piping at all locations.

1. Provide metal jacketing at locations exposed to weather.

3.03 PIPING APPLICATION

A. Apply insulation to clean dry pipes after all pressure tests have been completed. Firmly butt all joints of insulation and seal all joints per manufacturer's recommendations.

B. Flanges, strainers, and unions shall be insulated with pre-molded or shop fabricated rigid insulation of same material and thickness as specified for adjacent piping. Cover fiberglass insulation with pre-molded PVC covers, held in place with Johns Manville Zeston Z-tape. Covers and finish for foam glass and calcium silicate insulation shall be as specified for the adjacent pipe insulation. Ensure that insulation and covers for flanges, unions, strainers, and access plates shall be removable without damage to insulation or jackets.

1. Insulate and cover all valves, tees, elbows, and other fittings the same as for flanges, strainers, and unions. Valve operators, pressure/temperature plus, meters, gauges and all other items which extend through required insulation

shall be suitably insulated with removable caps to allow use without disturbing the insulation.

C. Hydronic piping shall be insulated with preformed fiberglass insulation with sealed lap joints using manufacturer's standard pressure sensitive self-sealing lap joint system. Seal butt joints using the manufacturer's standard pressure sensitive closure strip system. Butt strips shall be a minimum of 3 inches wide.

D. Hangers and supports shall be provided with metal pipe saddles to hold calcium silicate blocks in position and provide an even transition between the insulation, blocking, pipe hanger and adjacent fiberglass insulation. Extend vapor barrier across all calcium silicate pipe blocking including through pipe hanger.

E. Metal jacketing shall extend over PVC jacketing or vapor barrier, down through roof. Longitudinal seals shall provide a 3 inch overlap installed at the 9 o'clock or 3 o'clock positions to shed water. Butt joints shall be overlapped a minimum of 3 inches in a manner to prevent entry of water. Seal metal jacketing with ¾ inch stainless steel sealing bands installed on 12 inch centers, minimum, along the metal jacket. Locate strap joints to prevent personnel contact. Metal jacket on valves and flanges shall be removable without disturbing the adjacent jacket.

F. Extend piping insulation without interruption through walls, floors and similar penetrations.

G. Provide adequate ventilation during initial start-up of piping systems to remove smoke and odor given off when the organic binders in the insulation are initially heated.

3.04 AFTER INSTALLATION CHECK

A. Visually inspect the complete installation and repair or replace any improperly sealed joints.

B. Where there is evidence of vapor barrier failure or wet insulation after installation the damaged insulation shall be removed, the surfaces shall be cleaned and dried and the new insulation shall be installed.

END OF SECTION

SECTION 23 21 13

HYDRONIC PIPING, VALVES, AND SPECIALTIES

PART 1 – GENERAL

1.01 DESCRIPTION

A. This Section covers the furnishing and installation of hydronic piping, valves, and specialties as indicated on the Contract Drawings and Schedules and as specified herein. Included, but not limited to the following, shall be thermometers, differential pressure sensors, air vents, strainers, pressure gauges, air separator, and flow control devices and complete factory assembly of all components.

B. Unless otherwise noted, all devices shall be rated for 125 PSI working steam pressure (WSP) and shall be suitable for the systems maximum pressure.

PART 2 – PRODUCTS

2.01 PIPE

A. Pipe shall be new, free from scale, and of the material and weight specified under the various services. Each length of pipe shall be properly marked at the mill for proper identification with name or symbol of manufacturer.

B. Copper tubing shall be of weight as required for service specified, with conformance with ASTM B-88 for types "L" and "K" tubing, as manufactured by Chase, Anaconda, Revere, or equal, for piping 2 inches and smaller in size.

C. Copper tubing shall be joined with 95-5 tin-antimony lead free solder as herein specified.

D. Dielectric fittings for connecting piping of dissimilar metals shall be as manufactured by Epco, Inc., or equal.

E. Pipe Schedule: Pipe for hot water heating shall be as follows:

	Service	Material	Schedule
1.	Overflow and Drain	Copper	Type K
2.	Hot Water Heating	Copper	Type L
3.	Vent (water discharge)	Copper Tubing	1/4 inch Type L

2.02 FITTINGS

A. Fittings shall be as specified under "Fitting Schedule" for various services.

Fitting Schedule: Fittings for Hot Water Heating shall be as follows:

Service	Size	Material	Weight	Type
Overflow & Drain	All	Wrought Copper	125 lb. (Lead Free)	Solder
Hot Water Heating	2 inch & below	Wrought Copper	125 lb.	95-5 Solder (Lead Free)
Vents (water discharge)	All	Wrought Copper	125 lb.	Solder (Lead Free)

B. Fittings shall be of material conforming to the following schedule:

Solder Fittings ASTM B-88

C. Bronze fittings shall be manufactured by Crane, or equal.

D. Unions 2 inches and smaller shall be screwed. Screwed unions on copper pipe shall be brass, ground joint suitable for 300 pounds W.S.P. Unions shall be as manufactured by Crane or equal.

E. Solder for each solder-type fitting shall be of 95 percent tin and 5 percent antimony.

F. Fittings shall be of the eccentric reducing type, where changes of size occur in horizontal piping to provide for proper drainage or venting.

G. Pressure ratings are for working steam pressure (WSP), with 125 pounds per square inch as a minimum.

2.03 PIPE HANGERS AND SUPPORTS

A. Provide necessary structural members, hangers and supports of approved design to keep piping in proper alignment and prevent transmission of injurious thrusts and vibrations. Hangers and supports shall be capable of screw adjustment after piping is erected. Hangers supporting piping expanding into loops, bends and offsets shall be secured to the building structure in such a manner that horizontal adjustment perpendicular to the run of piping supported may be made to accommodate displacement due to expansion. Such hangers shall be finally adjusted, both in the vertical and horizontal direction. Hangers in contact with copper pipe shall be copper

plated steel. Piping supports shall conform to ANSI B31.1, Standard Code for Pressure Piping, and conform to the Manufacturer's Standardization Societies Standards, MSS-SP-58, MSS-SP-69, and MSS-SP-89. However, ANSI B31.1 shall take precedence.

B. Pipe hangers shall be the clevis and pipe roll types, as scheduled below except where otherwise noted.

PIPE HANGER SCHEDULE

Pipe Type of Hanger	Fig. No.	Grinnell Fig. No.	F&M Fig. No.	Carpenter & Paterson
All sizes	Clevis Hanger	260	239	100

C. Hangers supported from floor and roof steel shall be approved beam clamps. I-beam clamps for hangers supporting piping 2 inches and smaller shall be C & P Fig. No. 148 adjustable beam clamps.

D. Vertical piping shall be anchored by means of heavy steel clamps securely bolted or welded to the piping, and with end extension bearing on the building's structural framing.

E. Vertical piping shall be supported at each floor by use of clamps fastened to building structure.

F. Vertical runs of pipe not over 15 feet long shall be supported by hangers placed not over one foot from the elbows on the connecting horizontal runs.

G. For hot water heating piping 2 inches and smaller, provide "Insulshield" as made by Insulcoustic Corp. or pipe covering protection shield C & P Fig. 265P with steel shield minimum 9 inches long, with vapor barrier jacket at each support.

H. Hanger rods shall be in accordance with the California Mechanical Code Table 316.

I. Piping shall not be hung from other piping, ducts, conduits, or from equipment of other trades. Hanger rods shall not pierce ducts.

J. Where additional steel is required for the support of hangers, furnish and install supplemental steel subject to the review of the Engineer.

2.04 VALVES

A. Valves-General: Valves shall be of a design which the manufacturer lists for the service and shall be of materials allowed by the latest edition of the ASME Code for pressure piping for the pressure and temperature contemplated, unless a higher grade or quality is herein specified. However, 125 psig WSP shall be the minimum acceptable rating. Valves shall be of the same manufacturer, except for special applications.

B. Valves 2 inches in diameter and smaller shall be all bronze with bronze bodies.

C. Drain valves shall be provided on tanks, receivers, risers and where they may be required or necessary, for draining the lines and equipment. Drain valves of minimum one inch size shall be provided at the low points for proper drainage. Valves shall be provided with threaded ends for drain connections.

D. Valves up to 2 inches in diameter shall have screw ends.

E. Bronze valves shall be furnished with Teflon impregnated packing.

F. Valves for hot water heating systems shall be of type and model number as specified below, except as otherwise noted.

G.

Hot Water Heating System Valves in Copper Tubing:

TYPE	SIZE	CRANE NO.	JENKINS NO.	WALWORTH NO.	REMARKS
Gate Valve	2 inch & Smaller	1320	1240	4-SJ150	125 lb. WSP, Bronze

TYPE	SIZE	CRANE NO.	JENKINS NO.	WALWORTH NO.	REMARKS
Swing Check	2 inch & Smaller	1303	---	406SJ	125 lb. WSP, Bronze

H. Balancing Valves: 1/2 inch to 2 inch size: Model CB as manufactured by Bell and Gossett, or equal. Valves shall have differential pressure readout ports and one drain/purge port. Valves shall have memory stop feature and calibrated nameplates.

I. Ball Valves:

1. Ball Valves up to 2 inches may be used for all water services as an alternate to gate valves and globe valves.
2. Ball valves shall be full port bronze body, bronze ball and stem Teflon seats and seals, threaded ends, 400 psig W.O.G. Nibco or equal.

2.05 THERMOMETERS

A. Furnish and install, where indicated on the Drawings and where specified herein, separable well-type dial or 9-inch, mercury-adjustable, angle-type in glass stem, thermometers as manufactured by American, Trerice, Weksler, Weiss or equal.

B. Instrument wells for controls and indicators furnished by the temperature control manufacturer shall be installed under this Section.

C. Provide a thermometer at each automatic control sensor or bulb. Additional thermometers shall be provided where indicated on the Drawings.

2.06 EXPANSION JOINTS, LOOPS, ANCHORS, AND GUIDES

A. Provisions for expansion in piping mains, branches, and risers shall be made by the installation of offsets, expansion loops, or compensators as indicated on the Drawings and as required. Every 100-foot-long horizontal run of hot water piping shall have expansion loop and anchors. Minimum loop shall be 8 feet by 6 feet if not indicated on the Drawings.

B. Piping with loops or compensators shall be anchored so as to direct all expansion toward the loops or compensators.

C. Guides shall be provided on both sides of each expansion loop and compensator. Guides shall be Flexonics pipe alignment guides or equal. Anchors and guides shall be secured to beams, columns or concrete slabs.

D. Pipe hangers and rollers are not considered guides.

2.07 AIR VENTS

A. High points and air pockets in water piping systems shall be kept to a minimum and shall be properly vented where unavoidable. Air elimination devices called for on the Drawings and in the Specification shall be provided and properly installed. In addition, furnish and install all other air elimination devices that may be required at air pockets in piping due to job conditions. Assume responsibility for a proper, continuous and automatic air elimination to assure even and balanced distribution of water to all equipment.

B. Furnish and install an Armstrong No. 1 AV or Sarco 13W automatic air vent with test valve at each high point in the water piping mains and where indicated on the Drawings. Furnish and install a 125 psig rated valve on the system side of each automatic air vent. Vents on hot water lines shall have Hoke Fig. No. PY-271 valves or equal. Vents on all other water lines shall have Hoke Fig. No. RB-271 valves or equal.

2.08 STRAINERS FOR HOT WATER SYSTEM

A. Furnish and install a full-size Y-pattern strainer on the inlet of each control valve and each water pump, where indicated on the Drawings.

B. The strainers shall be as manufactured by Spence, Sarco, Barnes and Jones, Elliot, Crane or Mueller.

2.09 DIFFERENTIAL PRESSURE SENSORS

A. Furnish and install differential pressure sensors in accordance with manufacturer's instructions.

B. Sensors shall be liquid compatible with temperatures and pressures for system they are installed within. Wetted materials shall be 316 or 316L stainless steel. Accuracy shall be plus or minus 0.5% with an upward temperature limit of 200F.

C. Output signal shall be 4 to 20 mA and be converted to optional 0-10 VDC based upon control system input requirements.

2.10 PRESSURE AND TEMPERATURE TEST STATIONS

A. Furnish and install in each supply and return runout to each hot water reheat coil and also where indicated on the Drawings, a 1/4 inch MPT fitting to receive either a temperature or pressure probe 1/8 inch OD. Fitting shall be solid brass with valve core of Nordel (Maximum 275°F), fitted with a color coded and marked cap with gasket, and shall be rated at 1000 psig.

B. Provide one pressure and temperature test kit consisting of one 0-60 PSI water pressure gauge and one 0-30 PSI water pressure gauge each with No. 500 gauge adapter attached, a 25-125 degrees F pocket testing thermometer, a 0-220 degrees F pocket test thermometer, a No. 500 gauge adapter, and a protective carrying case. Provide one additional 0-60 PSI pressure gauge and one additional zero to 30 PSI pressure gauge.

2.11 CIRCUIT SETTER FLOW CONTROL VALVE

A. Furnish and install flow control valves for balancing heating hot water flow through individual heating coils. Valves shall be of bronze body/brass ball construction with glass and carbon filled TFE seat rings. Valves shall be capable of operating at 300 psi and 250°F conditions.

B. The flow control valves shall be Bell & Gossett Circuit Setter Plus models, for flow through heating coils as indicated on drawings. To assure calibrated accuracy a minimum length of unrestricted straight pipe adjacent to the valve should be maintained: allow at least 3.5 pipe diameters upstream of the circuit setter and 1.5 pipe diameters downstream of the circuit setter.

PART 3 – EXECUTION

3.01 PREPARATION

A. Contractor shall examine locations where the piping is to be installed and determine space conditions and Owner in writing of conditions detrimental to proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF PIPING

A. Coordinate with other work as necessary to interface installation of piping with other components of systems.

B. The Drawings indicate schematically the size and location of piping. Piping shall be set up and down and offset to meet field conditions and to provide adequate maintenance room and headroom in the boiler rooms.

C. All exposed piping shall be run perpendicular and parallel to floors and interior walls. Piping and valves shall be grouped neatly and shall be run so as to avoid reducing head-room or passage clearance. Provide min. 7'-6" headroom under passageways in boiler rooms. Valves, controls and accessories concealed in furred spaces and requiring access for operation and maintenance shall be arranged to assure the use of a minimum number of access doors.

D. Valves and specialties shall be so placed as to permit easy operation and access.

E. Provide proper provisions for expansion and contraction in all portions of pipe work, to prevent undue strains on piping or apparatus connected therewith. Provide double swings at riser transfers and other offsets wherever possible, to take up expansion. Arrange riser branches to take up motion of riser.

F. Piping connections to coils and equipment shall be made with offsets provided with screwed unions so arranged that the equipment can be serviced or removed without dismantling the piping.

G. Install piping in accordance with the latest edition of the ANSI Code for Pressure Piping, B31.1.

H. Dissimilar piping shall be connected with dielectric connectors.

I. Support piping at all equipment and control valves to prevent strains or distortions in the connected equipment and control valves. Piping shall be supported to allow for removal of equipment, valves and accessories with a minimum of dismantling and without requiring additional supports after these items are removed.

3.03 FIELD QUALITY CONTROL

A. Test of water piping:

1. Test water piping at completion of roughing in, in accordance with the following schedule and show no loss in pressure or visible leaks after a minimum duration of four hours, or time indicated, at the test pressures indicated.

2. Make connections to existing systems with flanged connections. During testing of the new work, provide a slip-in plate to restrict test pressure to new systems only. Remove plate and complete connection to existing system at completion of testing.

3. Inspect pressure piping in accordance with procedures of ANSI B31.

4. For systems operating at less than 100 pounds per square inch operating pressure test hydrostatically to 150 pounds per square inch.

5. For systems operating at more than 100 pounds per square inch operating pressure test hydrostatically to 1-1/2 times operating pressure but do not exceed test pressure ANSI 16.1 basis.

6. Test Duration shall be for a minimum of two hours with system valves capped and pressure apparatus disconnected. Pressure change during test period shall be zero. Compensate for temperature change.

7. Leaks and defects shall be repaired or replaces as directed by the Owner's Representative at no additional cost to the Owner.

3.04 CLEANING

A. During construction keep openings in piping closed to prevent entrance of foreign matter. Clean pipe, fittings and valves internally. Hammer welds to remove slag and beads.

B. Clean system after pressure test. Do not let system sit filled with un-chemically treated water for more than 4 hours.

1. Should any pipe be plugged or should foaming of water systems occur, disconnect piping, clean again, and reconnect at no additional cost to the Owner.

END OF SECTION

SECTION 23 51 23

GAS FIRED EQUIPMENT VENTS

PART 1 – GENERAL

1.01 DESCRIPTION

A. This Section covers the furnishing and installation of gas-fired equipment vents, as indicated on the Contract Drawings and as specified herein. Included in flue assembly, but not limited to the following, shall be flue pipe, thimbles, flue tops, sealants, joints, and supports and anchors.

B. All work of this section shall comply with Section 23 00 00 GENERAL REQUIREMENTS - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

1.02 CODES AND APPLICABLE STANDARDS

A. In addition to 23 00 00 General Requirements for Mechanical requirements the following shall also apply:

1. All products furnished under this Section shall conform to the requirements of The National Fuel Gas Code, ANSI Z223.1/NFPA-54 where applicable and shall comply with and be listed to UL 1738, the U.S. Standard for Venting Systems for Gas-Burning Appliances, Category II, III, and IV. Components coming in direct contact with products of combustion shall carry the appropriate UL labels.

PART 2 – PRODUCTS

2.01 CONDENSING EQUIPMENT FLUES AND INTAKES

A. AL 29-4C stainless steel alloy (UNS S44735) UL Listed, Category 2 stainless steel vent piping confirming to UL-1738 Standards.

2.02 SEPARATED COMBUSTION VENTS

A. Description: Venting system shall consist of a single wall vent pipe between the heater and the concentric adapter box and a double wall, Type B vent for the vent terminal section. The concentric adapter shall be provided by the furnace manufacturer. In addition the vent system shall include a tapers as required, roof thimble, cone flashing, combustion air vent inlet and a flue vent (exhaust) terminal.

1. Vent Pipe: Sealed single wall, 26 gauge galvanized pipe.

2. Double Wall Pipe: UL Listed Type B vent with stainless steel inner pipe and galvanized sheet metal outer pipe, as manufactured by Selkirk or equal.

B. Accessories: Tees, elbows, increasers, metal cap with bird barrier, adjustable roof flashing, storm collar, support assembly, fire-stop spacers, and fasteners, fabricated of similar materials and designs as vent pipe straight sections.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Coordinate flue installation with work at walls, ceilings and various trades as necessary for proper interfacing and installation.

1. The vent system shall be routed to maintain minimum clearance to combustibles as specified by the manufacturer.

2. Obtain approval on changes from the design prior to the flue vent installation.

B. Vent Installation shall conform to the manufacturer’s installation instructions, its UL listing and state/local codes

C. Seal between sections of positive-pressure vents according to manufacturer's installation instructions, using only sealants recommended by manufacturer.

D. Seal sections and fittings of PVC water heater vent pipe gas tight with solvent welding cements.

3.02 INSPECTION

A. Perform the following activities prior to the vent installation:

1. Verify that all openings for the flue vent system are of the size shown on plans, all openings are in the location shown on the Drawings, and all openings are clear of obstructions which might interfere with the installation of the ductwork or accessories.

2. Verify the proposed flue vent route is clear of conflicts.

B. The vent system and breechings shall be inspected and cleaned before the final connection to the appliances.

3.03 INSTALLATION/APPLICATION/ERECTION

A. Install gas vents as indicated, according to manufacturer’s written installation instructions. Locate to comply with stipulated minimum clearances from combustibles.

B. Seal between sections of positive-pressure vents according to manufacturer’s installation instructions, using only sealants recommended by manufacturer.

C. Support vents at intervals recommended by the manufacturer to support the weight of the vent and all accessories, without exceeding loading of appliances.

3.04 ADJUSTING AND CLEANING

A. Confirm flue vent is free of construction debris.

B. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes, including chips, scratches, and abrasions.

C. Clean breechings internally during installation to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth.

3.05 WARRANTIES

A. In addition to 23 00 00 General Requirements for Mechanical the following shall also apply:

1. The manufacturer shall warrant the Positive Pressure Boiler Vent System against defects in material and workmanship for a period of 15 years from the date of the original installation. Any portion of the vent repaired or replaced under the warranty shall be warranted for the remainder of the original warranty period.

END OF SECTION

SECTION 26 00 00

GENERAL REQUIREMENTS - ELECTRICAL

PART 1 – GENERAL

1.01 DESCRIPTION

A. The requirements of this section apply to all sections of Division 26 and the contract documents.

1.02 WORK INCLUDED

A. Provide all incidental electrical materials, equipment, labor, fabrication, specialties, and items necessary and incidental to the installations of a complete system or piece of equipment.

B. Work included shall also include transportation, storage, utilities and required licenses and permits.

C. Work included shall also include all breakers, wiring, conduit, supports and ancillary items necessary for the full and complete installation of the boiler replacement as detailed on the Drawings.

1.03 RELATED WORK AND REQUIREMENTS

A. The work of this Section shall require work in coordination with other Divisions outside of this Section as follows:

1. Section 01 00 00 General Requirements

2. Section 21 00 00 HVAC

1.04 QUALITY ASSURANCE

A. Comply with Division 01 requirements regarding Quality Control.

B. Visit the site included in the scope of work to ascertain existing conditions. Verify all dimensions and locations before proceeding with work in the area and prior to purchasing equipment.

C. Review and coordinate between all construction documents, all project specifications, and all sections prior to proceeding with work.

1.05 SUBMITTALS

A. Comply with Division 01 requirements regarding submittals.

B. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.

C. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

D. Prior to submitting layout drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

E. Upon request by Engineer, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with telephone numbers and e-mail addresses.

1.06 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Owner has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.

2. Place damaged equipment in first class, new operating condition; or, replace same as determined and directed by the Engineer.

3. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.

4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Equipment and Products:

1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping or ductwork.

2. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.07 CODES, REGULATIONS, STANDARDS, AND GUIDELINES

A. Work shall be in accordance with requirements of the latest jurisdiction adopted editions of the following:

1. CEC - California Electrical Code, 2022 Edition

2. CMC - California Mechanical Code, 2022 Edition

3. CPC - California Plumbing Code, 2022 Edition

4. CFC - California Fire Code, Latest Edition

5. UL Underwriters Laboratories

6. SFM State Fire Marshal

B. When the work calls for more stringent requirements than the above listings the Specifications and Drawings shall take precedence.

1.08 SITE VISIT AND FAMILIARIZATION

A. Visit the site and become familiar with the Drawings and Specifications. Examine the site and understand the conditions under which the Contract shall be performed.

B. Refer to Division 01 for any Pre-Bid Conference requirements.

1.09 REVIEW OF CONSTRUCTION

A. Work may be reviewed, without prior notice, at any time by representatives of the Owner.

B. Advise Owner when work is ready for review at the following times:

1. Prior to concealment of work in walls.

2. Prior to concealment of work and above ceilings and any other enclosable spaces. Conceal Work only after obtaining Owner and Architect consent.

3. Maintain an on the job set of Specifications and Drawings for use by Owner and representatives.

1.10 BID DOCUMENT DESCRIPTION

A. Specifications describe quality of materials and equipment.

B. Drawings are diagrammatic and indicate the general arrangement of equipment and wiring. Exact requirements shall be governed by architectural, structural and mechanical conditions of the job. Consult other drawings in preparation of the bid.

C. Extra lengths of wiring or pull boxes or junction boxes, etc., necessitated by conditions shall be included in the bid. Report any apparent discrepancies before submitting bid.

D. Right is reserved by the Owner to make changes of up to ten feet in location of any outlet or equipment prior to roughing-in without increasing contract cost.

E. All equipment, systems and items indicated on the drawings and specifications are to be assumed as new unless specifically noted otherwise.

PART 2 – PRODUCTS

2.01 NOT USED

PART 3 – EXECUTION

3.01 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and handling shall be performed in accordance with manufacturer's recommendations. Provide dust and weather covers.

B. Protect materials from loss or damage. Lost or damaged materials shall be replaced with new at no increase in Contract Sum.

3.02 WORKMANSHIP AND CONTRACTOR'S QUALIFICATIONS

A. Installation of parts and connection of parts into systems shall be completed by skilled electrical journeymen. Material assemblies and installation work shall be securely fastened to structure, attractive in appearance and safe to operate. Provide code required clearance about electrical equipment. Assembly work or installations that are improper, unsafe or unattractive shall be removed and replaced with satisfactory work at no additional cost to the Owner.

B. Provide a foreman or superintendent in charge of this work at all times.

3.03 PROTECTION OF WORK

A. Porous materials that become wetted shall be replaced with new. Drying is not sufficient as it introduces the possibility of microbial growth. This applies to duct liner, insulation wrap, flex duct and any material that has the potential to absorb moisture.

3.04 CLEANING AND PRESENTATION

A. Prepare Work for painting by leaving surfaces free of oil, dust, rust, scale, adhesions and debris.

B. Remove all shipping labels and tags.

C. Cut ends of strut pieces and uncoated/non-galvanized steel materials exposed to the elements shall be painted with two coats of rust inhibiting paint with color and type matched to installation.

3.05 SAFETY

A. The contractor shall be solely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This shall also apply to normal and non-normal working hours.

3.06 CUTTING OF STRUCTURE

A. Do not cut beams, girders, columns, or any other structural members, or run any pipes, ducts or work through slabs, unless specifically shown on the Drawings, or unless written approval is obtained from the Owner.

B. Cutting of walls, floors, or other parts of the building or repairing any work due to neglect of properly directing the locations of necessary openings and framing beforehand shall be done at no additional cost to the Owner.

3.07 COMPLETION

A. When work is completed, or when Owner or Owner representative directs, remove surplus equipment, material, waste, and rubbish and leave building in satisfactory condition.

3.08 3.8 TESTS

A. Where the Contract Documents, laws, ordinances or any public authority requires any work to be tested specifically or reviewed by another authority, the Contractor shall give the Engineer/Owner timely notice of readiness therefor. The Contractor shall give the Engineer/Owner the test results for review. If any work to be tested is covered up without written approval or consent of the Architect, it must, if directed by the Architect, be uncovered for examination at the Contractor's expense.

B. The cost of all such tests shall be borne by the Contractor.

C. Any work which fails to meet the requirements of any test or any work which does not meet the requirements of the Contract Documents shall be considered defective and may be rejected. Rejected work shall be corrected promptly by the Contractor or removed from the site.

D. Provide written test reports for each test to the Engineer for review.

3.09 WARRANTEES AND GUARANTEES

A. Contractor is required to provide warranties in accordance with Division 01 – General Requirements.

1. Collect all warranties and guarantees for materials and equipment and neatly fill out all required information for the Owner. Provide one copy of each certificate for turn over to Architect. Arrange certificates in a tabbed and indexed binder for Architect ease of use.

B. At the completion of the work contractor shall guarantee to repair or replace materials and workmanship found defective for a period of one year from date of filing of Notice of Completion. This work shall be performed at no cost to the Owner.

1. Work of other trades damaged as a result of faulty workmanship or materials shall be repaired at no cost to the Owner.

END OF SECTION